Electron Identification + Event Characterization

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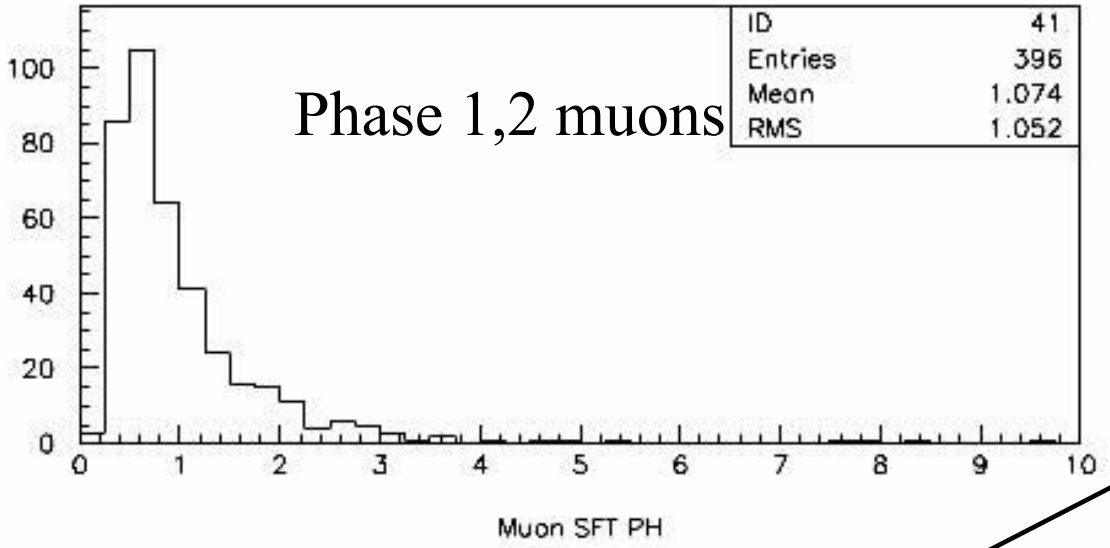
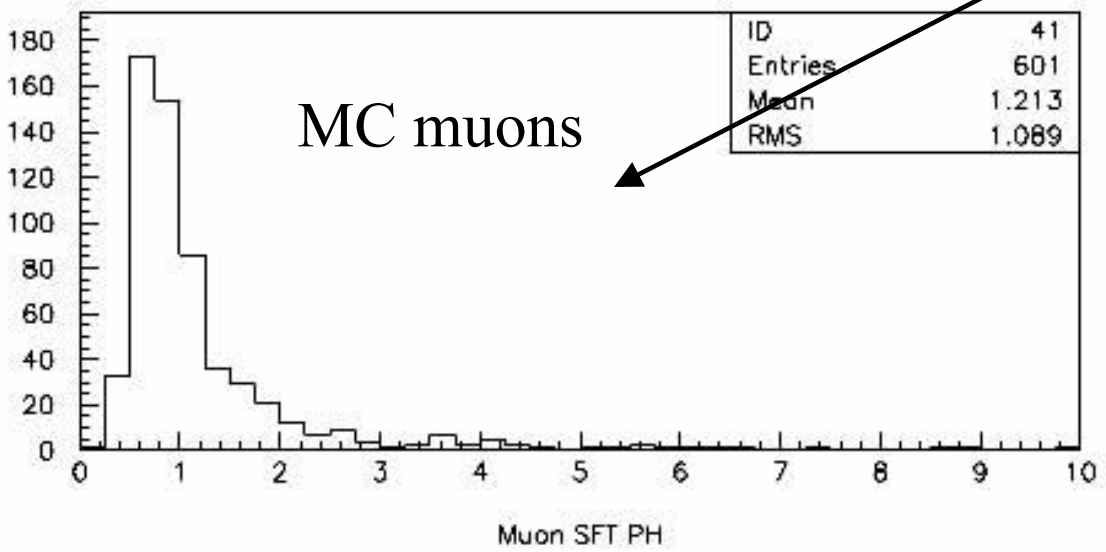
Recent revisions to SFT/EMCal Electron ID

- SFT pulse height summing scheme unchanged
  - Corrected MC pulse height calibration (~3X too large)
- Drop requirement of large track angle separation (40 mr)
- Side-band SFT pulse height subtraction
- Unique association of emulsion tracks w EMCal clusters
- Changed method for tagging electrons

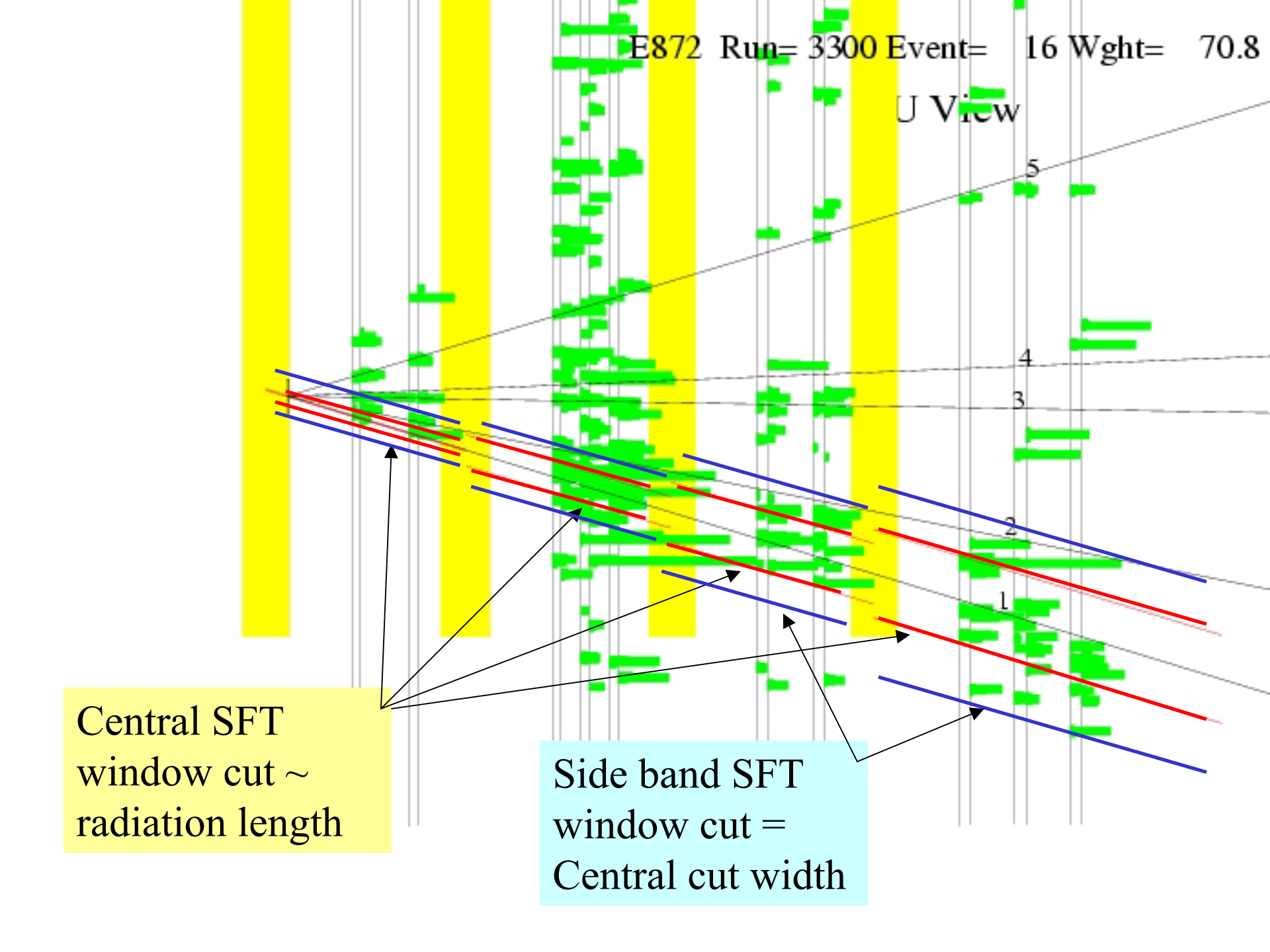
Data/MC SFT calibration





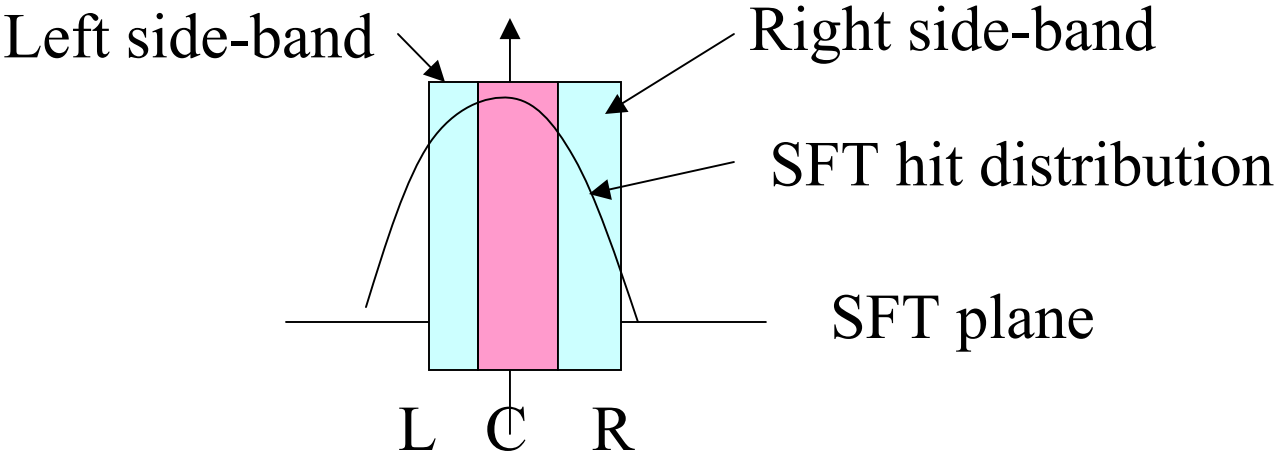
Sum muon PH using WID cut

MC pulse height after 3.2X reduction


E872 Run= 3300 Event= 16 Wght= 70.8
U View
5
4
3
2
1
Central SFT window cut ~ radiation length
Side band SFT window cut = Central cut width

Side-band Subtraction

Crude method of separating track PH from adjacent showers



C = Sum PH within WID = +/- .002 * radlength
L = Sum PH within WID on left
R = Sum PH within WID on right

If (L>C or R>C) set C = ½ * (L+R)

Compare PH in each view
Remove showers from track PH

PHn = pulse height in each view and station

PH rms = $[(PHX–PHU)^2 + (PHX-PHV)^2 + (PHU-PHV)^2]^{1/2}/<PH>$

- If PH rms > 0.5 there is an inconsistency between the views
  - Ignore the view with the highest pulse height

Electron/Hadron Selection

- nstn = number of stations traversed
- nlo = number of stations with low pulse height (<5 MIP's/plane)
- nhi = number of stations with high pulse height (>5 MIP's/plane)
- nbigrad = number of stations with >2 rad lengths
- Eclus = EMCal cluster energy within 20 cm

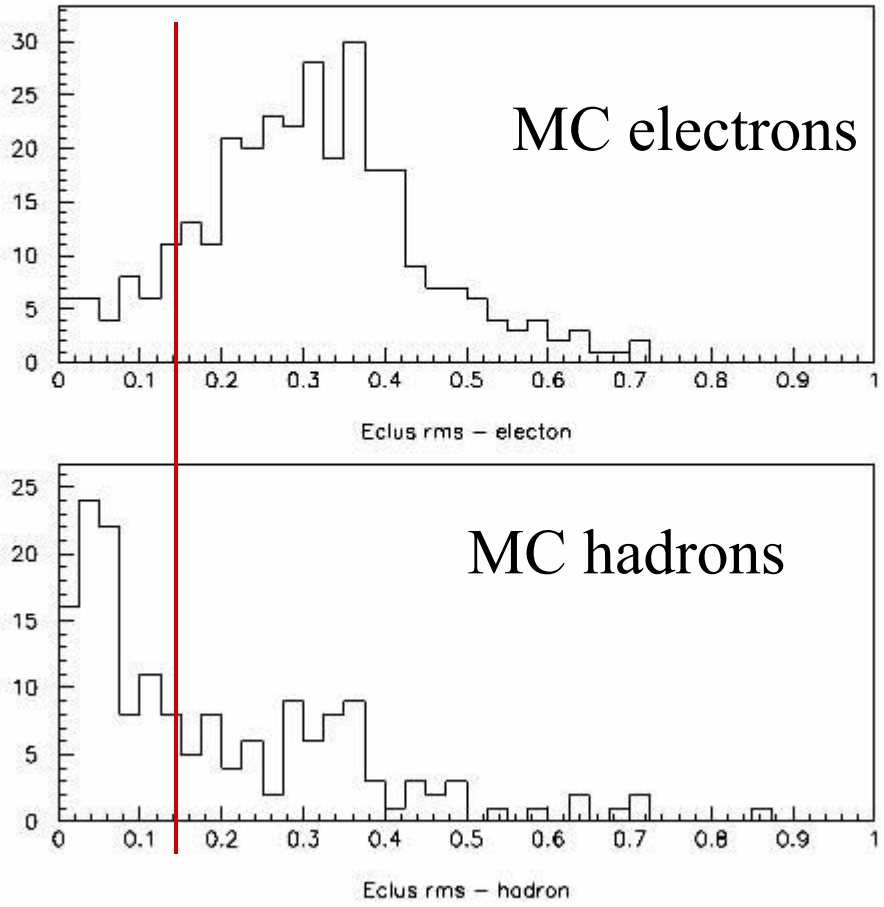
- *Hadron = nlo .eq. nstn .and. Eclus < 0.5 GeV*
- *Electron = nbigrad .gt. 0 .and. nhi .gt. 0*

Special case for station 4

- *Electron = nbigrad .eq. 0.and. nlo .gt. 0 .and. Eclus > 20 GeV*
- Tracks failing these cuts are declared hadrons

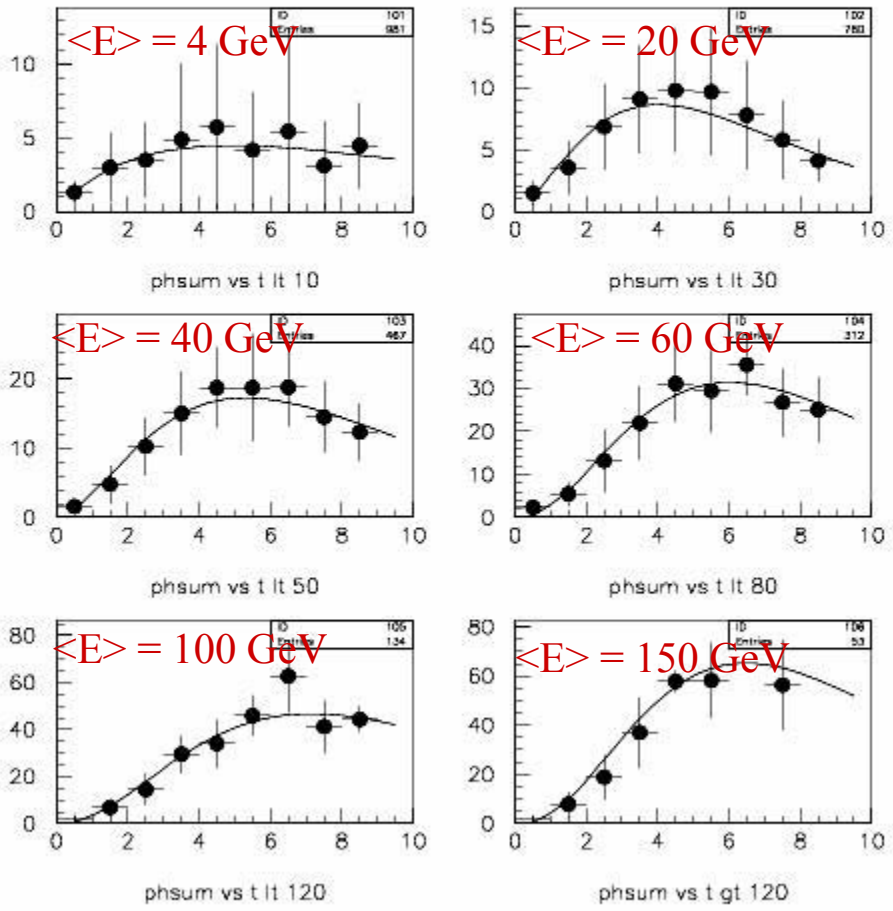
These cuts are not effective in identifying hadrons that shower in the EMCal for events in station 4

EMCal shower shape
e/π separation



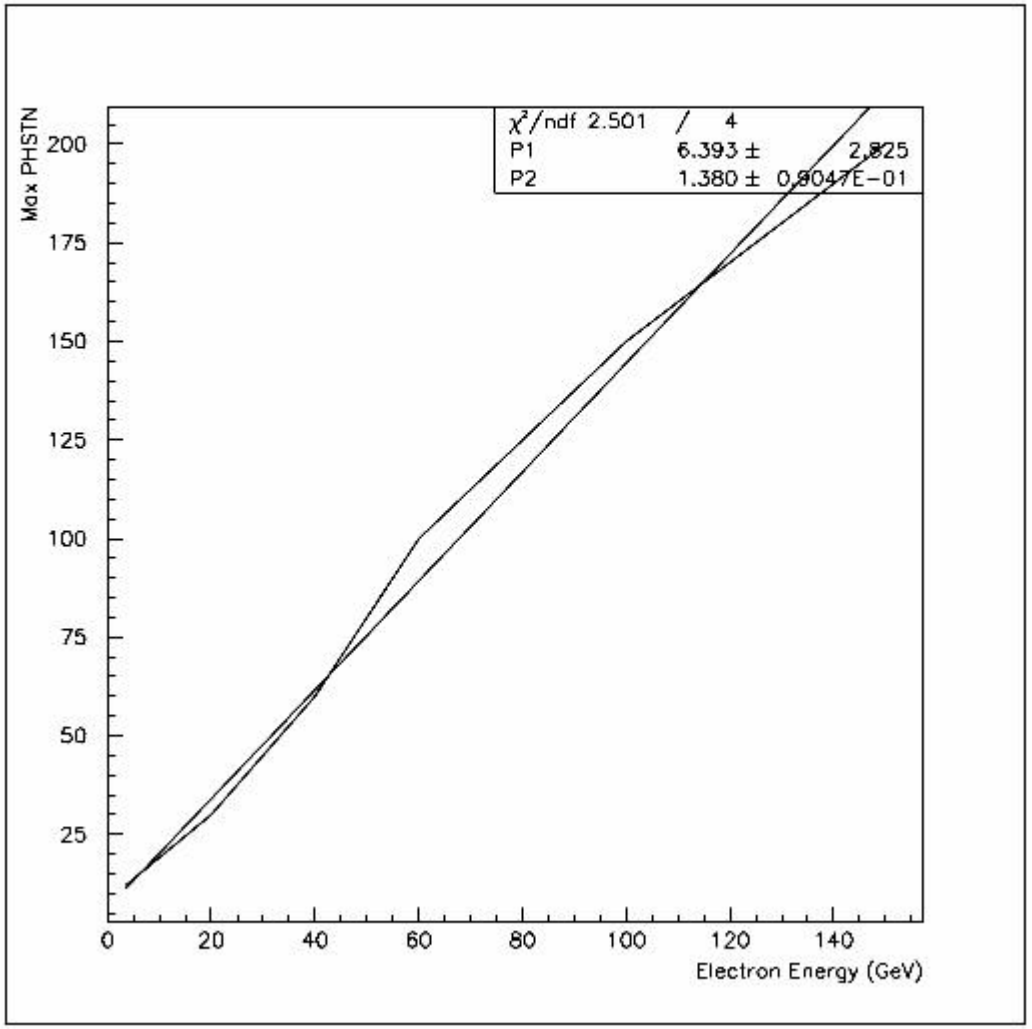
- Find Y width of EMCal shower associated with track
- Require central Eclus > 5 GeV
- Find Y rms using blocks within +/- 10 cm δX of projected track
- Set track Eclus = 0 if Y rms < 0.15 (preliminary cut)
- Y rms is ~independent of electron energy & radiation length

SFT Pulse Height vs t & Energy



- Histogram SFT pulse height vs radiation length (t) in 6 MC Truth energy bins
- Used 3k Period 4 MC events
- Fit parameters not used
- Find maximum phsum in each histogram
- Linear fit of E vs $phsum_{max}$

Electron energy estimate

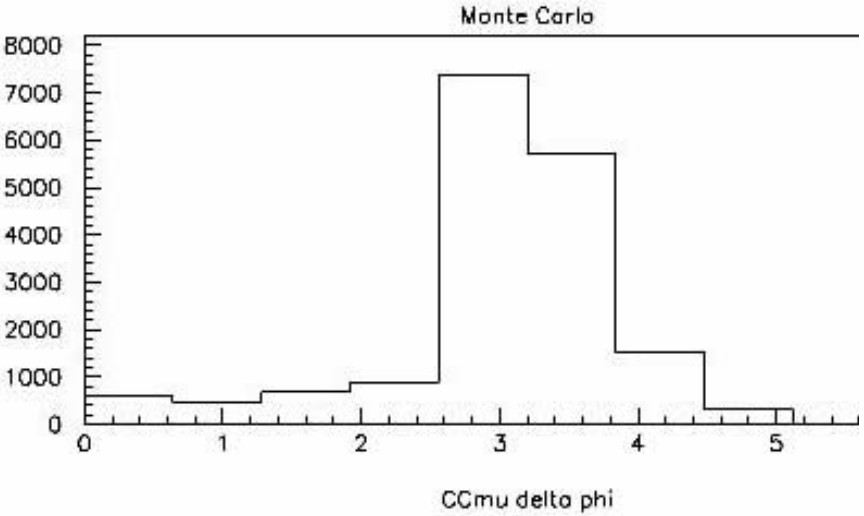


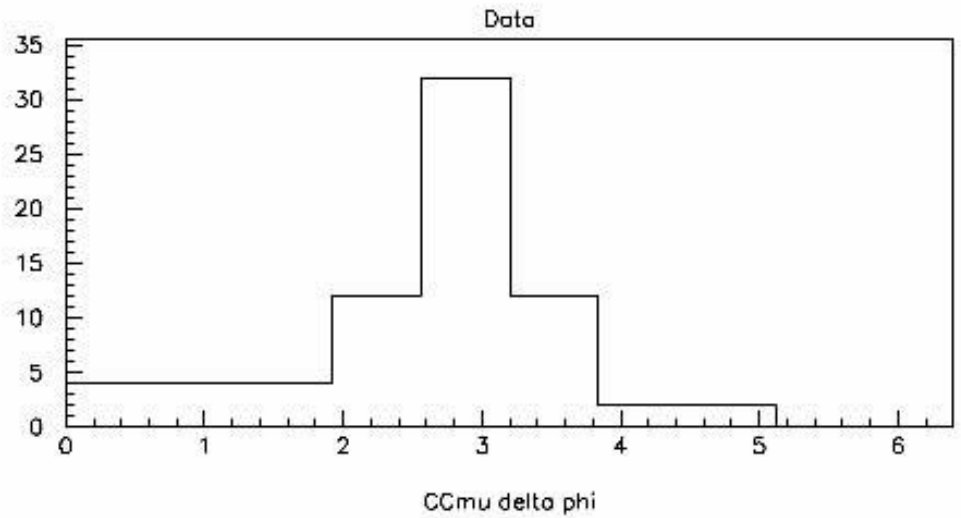
- If Eclus > 10 GeV, use Byron's estimator
  - E = (Eclus + 2.5 GeV)/(0.97 – 0.0929*t)
- If Eclus < 10 Gev use SFT
  - $E = 6 + 1.4*phsum_{max}$

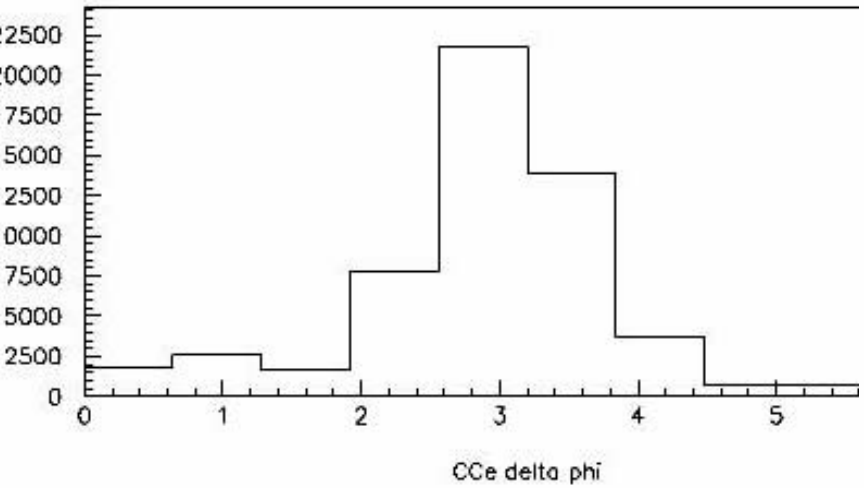
Event Characterization & Primary Lepton Selection

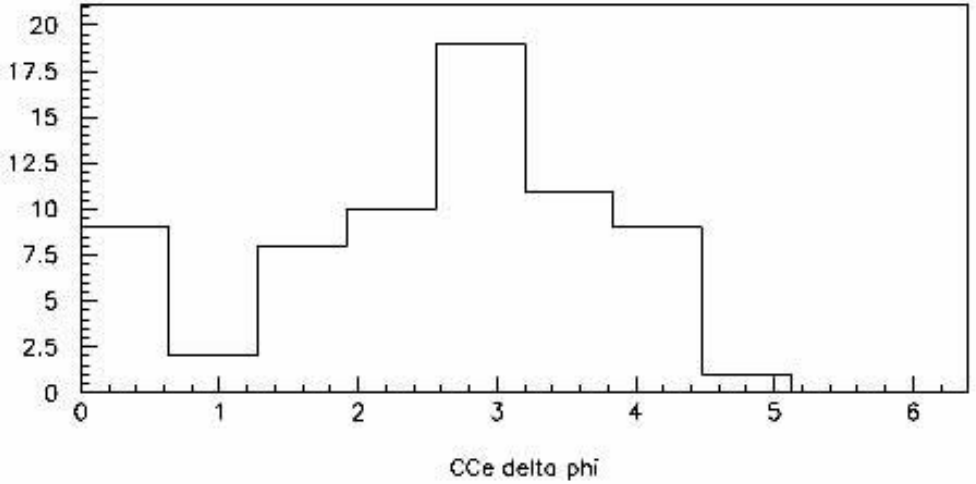
- If >3 MID hits → muon CC
- If 1 tagged electron track electron → CC electron
- If > 1 tagged electron assume there is only one primary electron + false positive electron tags
  - Find the track with the highest energy
  - Form a list of electrons with 50% of the maximum energy
  - If list contains > 1 electron (14% of 406 data events)
    - Primary electron = track with the best $\delta\phi$
- Store information in evt_info
  - Evt_lepton = primary lepton track number
    - 0 = NC, + = CCMu, - = CCe

Data/MC δϕ comparison
> 3 primary tracks









Monte Carlo Results: Efficiency & Purity

	Tag Ccmu	Tag Cce	Tag NC
True Ccmu	74%	4%	22%
True Cce	2%	79%	19%
True NC	2%	16%	82%
True Tau	16%	24%	61%

Data events are corrected by the inverse of this matrix (sans True Tau)

Phase 1 & 2 Results:
Preliminary

	Tag Ccmu	Tag Cce	Tag NC
Data events	164	93	149
MC Corrected	169	73	168
Location Eff	54%	37%	38%
MC & Loc Corr	313	198	441
Ratios	33%	21%	46%
Expected	41%	33%	23%

← From ANN

Event Types by Station

	Stn 1	Stn 2	Stn 3	Stn 4	All
Tag Ccmu	54	36	43	31	164
Tag Cce	28	18	23	24	93
Tag NC	42	29	42	36	149
CCe/Ccmu	52%	50%	53%	77%	57%
NC/Ccmu	78%	81%	98%	116%	91%

Station 4 problems remain

Compare with ANN

- ANN NC 104 events
  - 1 CCmu, 12 CCe, 91 NC (88%)
- ANN CCe 118 events
  - 4 CCmu, 75 Cce (64%), 39 NC

Visual Scan

	Tag Ccmu	Tag Cce	Tag NC
True Ccmu	72%	10%	18%
True Cce	7%	89%	4%
True NC	3%	24%	73%
True Tau	45%	55%	0%

Summary & Plans

- Rough agreement with expected event ratios
- MC/data differences need understanding
- Check CCmu events with tagged electrons